Space Weather Technical Forecast

Issued on Sunday, 07 November 2021 at 12:24 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance of M-class flares. Chance of isolated G1/Minor geomagnetic storms on Days 1 and 2. Active electron fluence likely late Day 1 or into Day 2.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: There are currently three active regions on the visible disc. AR2893 (Hsx/Alpha) near centre disk remains a single moderately sized unipolar spot and AR2894 (Hsx/Alpha) in the southeast quarter, with the small trailer spots re-classified as a new active region (Bxo/Beta). A further region of plage is crossing over the northeast horizon, and remains spotless at present. One small C-Class and several B-Class flares were evident in the last 24 hours, mostly from AR2894 near the southeast limb.

No significant Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, was mostly Elevated, around 540-580 km/s until around 07/0645 UTC when it reduced to Slightly Elevated. Density was around average, with a brief peak above average at 21ppcc at 07/0040 UTC, with a gradual decline to now below average values since 07/0645 UTC. Total IMF, Bt, was Weak. The north-south component, Bz, was also Weak, fluctuating between +4/-4nT. Phi angle remained mainly negative (towards the Sun). Geomagnetic levels were Quiet to Unsettled with a couple of Active intervals.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at background levels. The high energy electron flux (greater than 2 MeV) has exceeded the high threshold twice in the past 24 hours, from 06/1820-07/0045 UTC and again from 07/0830 UTC until present. The associated 24-hour electron fluence was below the Active (1e8 integrated pfu) threshold and is currently on a rising trend, with 8.51e7 integrated pfu recorded at 07/1200 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Low or Very Low with a continuing slight chance of M-class flares. No Earth Directed CMEs currently feature in teh forecast period.

Solar Wind / Geomagnetic Activity: Solar winds, starting at Slightly Elevated levels may return to Elevated with a chance of Strong later on Day 1 and early on Day 2 (7&8 Nov), before probably then easing back to Slightly Elevated levels on Days 3&4 (9&10 Nov.). Geomagnetic activity is likely to be Quiet to Unsettled with an increased chance of Active to G1/Minor Storm intervals on Day 1 (7 Nov.) and Day 2 (8 Nov.).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) will likely continue at high levels during the next 4 days, associated with diurnal peaks. Corresponding 24 hour electron fluence values are currently below the Active (1e8 integrated pfu) threshold, but an increasing trend is likely through the period. The Active threshold will probably be breached later on Day 1 (7 Nov.) or during Day 2 (8 Nov.), with low confidence for the exact timing of this event.

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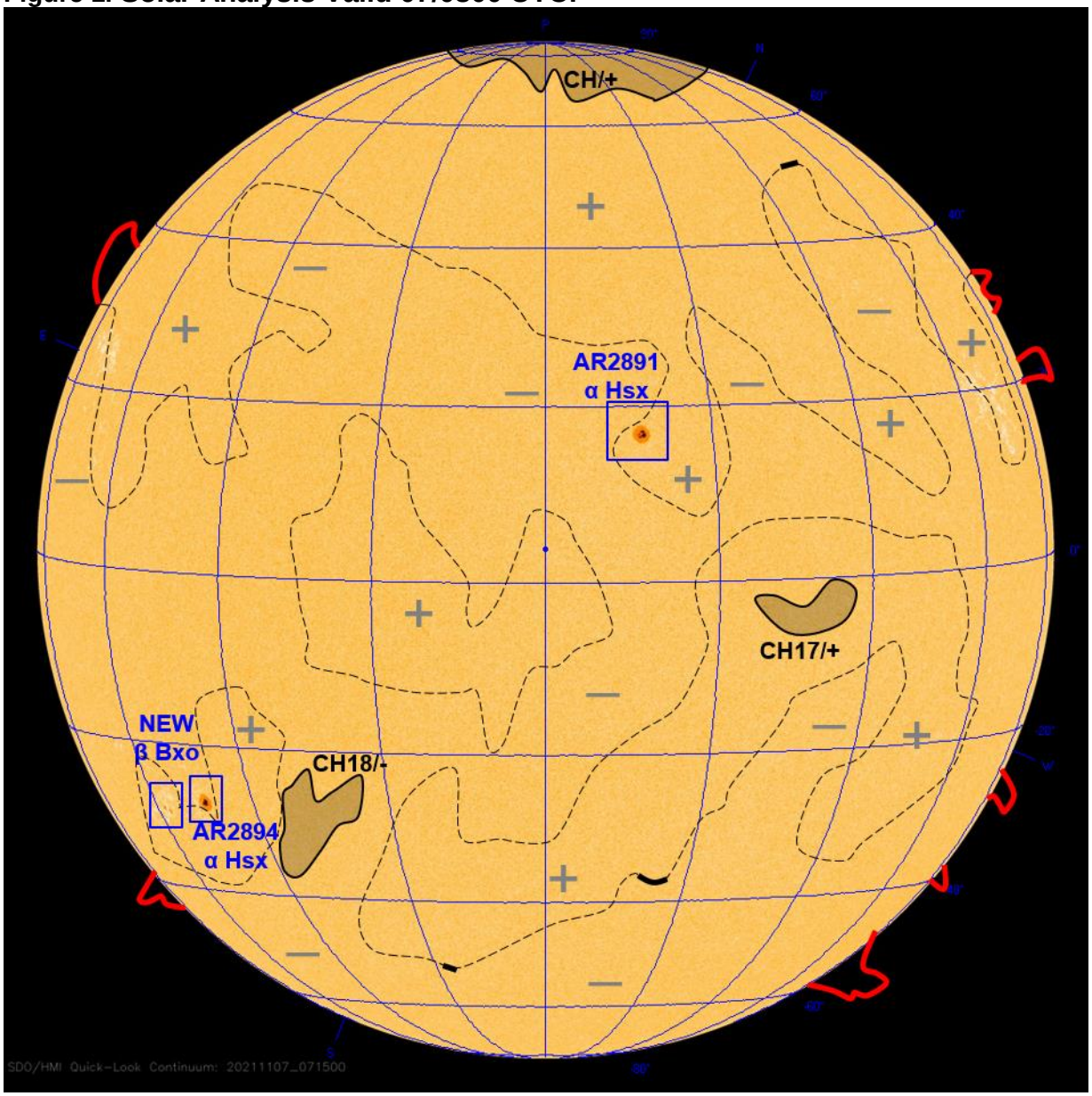
Figure 1. Solar Analysis Valid 07/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

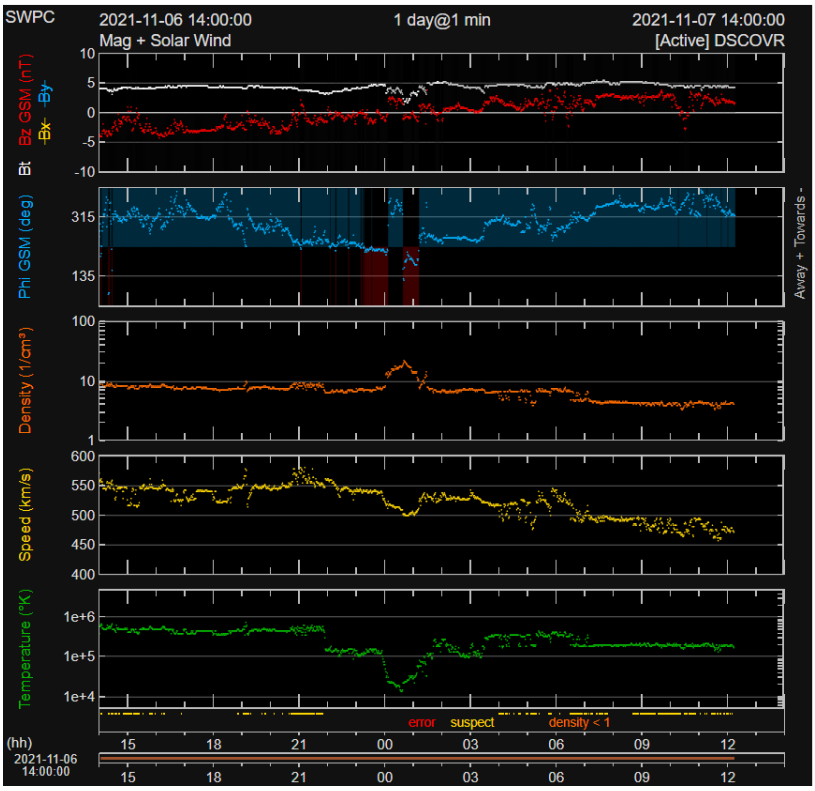
No Earth directed CMEs have been observed or are expected to be en-route at present.

Coronal hole (CH17/+) is in a geoeffective location in the west of the visible disk west, and just south of the solar equator. This feature looks a little different to last rotation (it's further advanced this time around). The most likely arrival time on this rotation is during Day 1 (7 Nov), with the solar wind returning to 550-600 km/s. STEREO-A appears to show signs of HSS influence however, solar winds currently affecting Earth are still being influenced from waning CME effects, so the HSS will probably increase wind speeds to Elevated.

Quiet to Unsettled geomagnetic activity is expected through much of the period, but perhaps with the greatest chance for Active to G1/Minor Storm intervals later on Day 1 and early on Day 2 (6 and 7 Nov.).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	30	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Real Time Solar Wind Trace from L1



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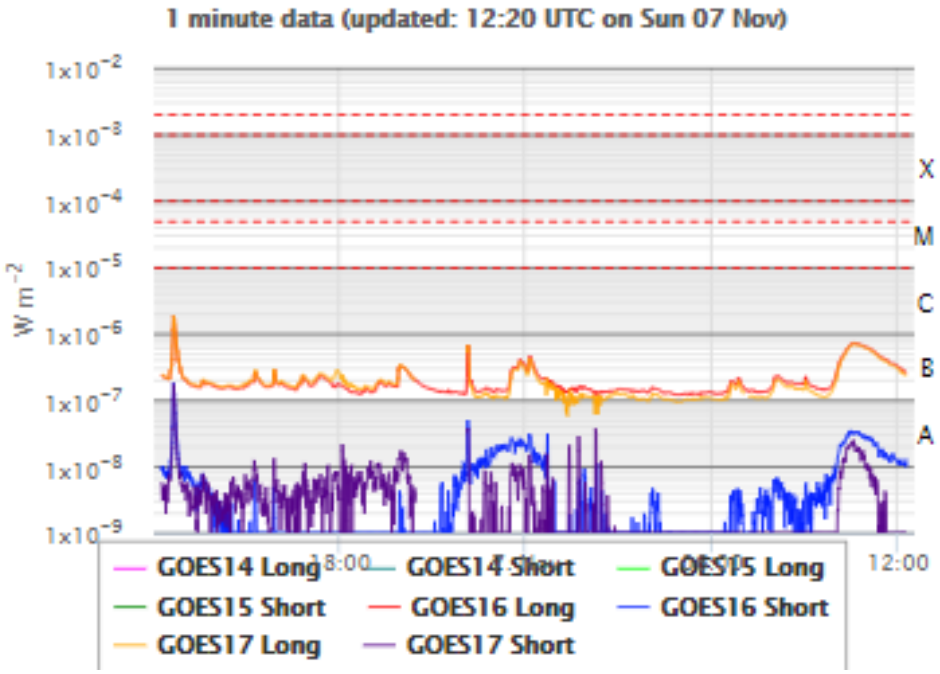
Radio Blackouts - X-Ray Flares:

There are currently three active regions on the visible disc, and these are currently becoming less complex with a trend for flares to be less frequent. Probabilities have been pegged back a little in light of the current evidence. Solar Activity from the numbered regions on the visible disc is expected to be at Very Low or Low levels, with a slight chance (5-10%) of isolated M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: Xray trace from GOES16



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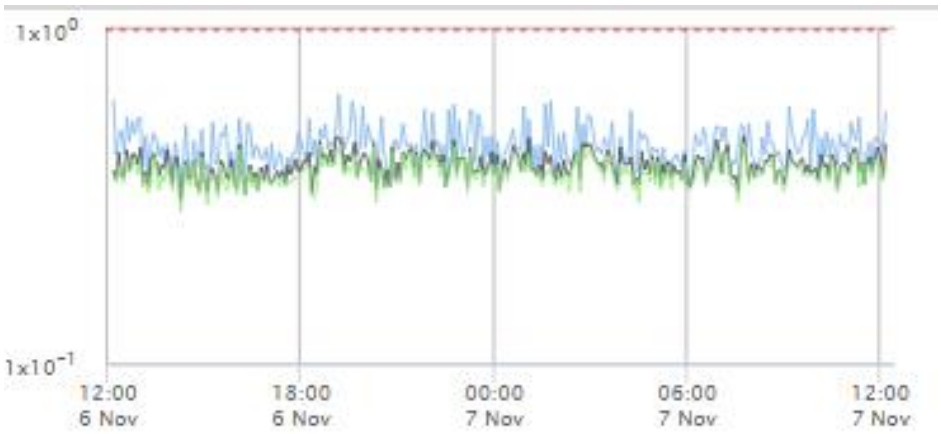
Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is at background levels, with little change likely.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Proton Trace from GOES16



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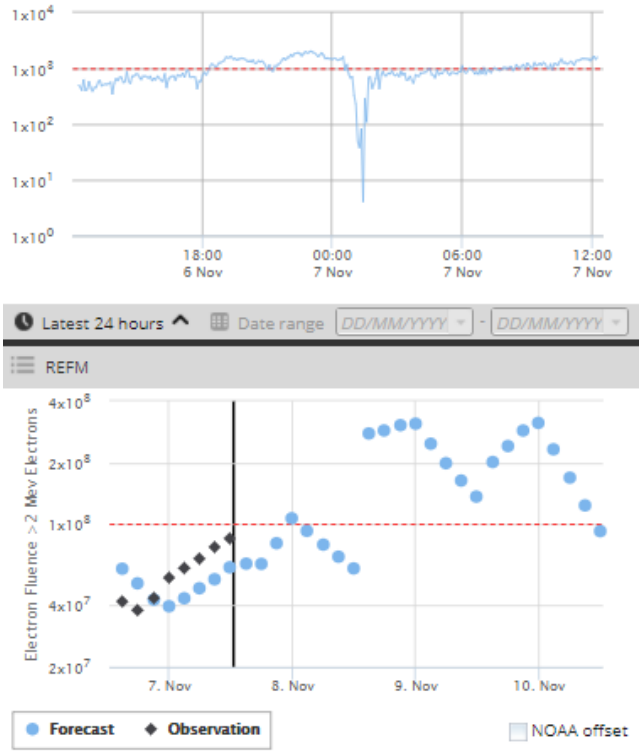
High Energy Electrons Event (≥ 2MeV):

During this current spell of Elevated to Strong solar winds and an anticipated connection with coronal hole 17/+ maintains an increased risk of exceeding the high threshold, more especially during diurnal peaks, perhaps with a slight rising trend through the period as the Van Allen belts recover.

Corresponding 24 hour electron fluence values are currently below the Active (1e8 integrated pfu) level, but with a rising trend. A continued increasing trend is likely through the period due to anticipated coronal hole influence. The Active threshold will probably be breached later on Day 1 or during Day 2 (7/8 Nov.) but confidence is low for the timing of this. The Met Office REFM output is considered to be giving reasonable guidance in the overall trend, but is currently under-estimating fluence levels in the forecast period.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	60	70	80	80
Very Active	≥ 2 MeV ≥ $1x10^9$	No	5	10	10	10

Figure 5: Electron flux (top) and REFM Fluence (bottom)



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